

# APPARATUS AND METHOD FOR ENHANCING DYNAMIC RANGE OF CHARGE COUPLED DEVICE-BASED SPECTROGRAPH

## ABSTRACT OF THE DISCLOSURE

The present invention is directed to an apparatus, method and software product  
5 for enhancing the dynamic range of a CCD sensor without substantially increasing the  
noise. Initially, the area of a  $N \times M$  pixel CCD sensor array is subdivided into two  
regions, a large region having  $(M - a)$  pixels in each column for outputting large-  
amplitude signals with low noise and a smaller region having  $a$  pixels in each column for  
outputting small-amplitude signals with improved dynamic range. At integration time,  
10 the CCD is read out one region's rows at a time into the horizontal shift registers by  
shifting the pixel charges in either  $a$  or  $M - a$  vertical shifts. The charges in the  
horizontal shift registers are then shifted out of the horizontal shift registers in  $N$   
horizontal shifts. Next, the remaining pixels in the region of the CCD are read out into  
the horizontal shift registers by shifting the pixel charges in the other of  $a$  or  $M - a$   
15 vertical shifts. Those charges are then shifted out of the horizontal shift registers in  $N$   
horizontal shifts. In a spectrographic application, the data from the two regions is read  
out in the form of a large-amplitude channel from the larger region's rows and a small-  
amplitude channel from the smaller region's rows.